Food and Agriculture Organization of the United Nations

Sustainable Forest Management Impact Program on
DRYLAND SUSTAINABLE LANDSCAPES
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Building resilience in Botswana's drylands: scaling up millet, lablab and Live fencing for restored livelihoods and landscapes

COUNTRY CONTEXT

Botswana's rural communities depend heavily on smallholder, rain-fed agriculture and livestock for their livelihoods and food security (Alemaw, Chaoka and Totolo, 2018), both of which are increasingly under pressure from recurring droughts, land degradation, and human-wildlife conflict. Unsustainable grazing and crop production combined with high livestock numbers, uncontrolled fires, and expanding agriculture are major drivers of forest and rangeland degradation. Field surveys conducted in the Tutume and Chobe Districts show that loss of productivity (66.3 percent), crop failure (73.7 percent), and declining water availability (34.7 percent) are commonly reported impacts of climatic shocks on households and farming systems (Buhrow *et al.*, 2025).

As climate variability intensifies, there is an urgent need to diversify and strengthen dryland farming and grazing systems to build resilience, restore ecosystems, and improve rural livelihoods. By addressing these pressures and promoting sustainable land management, Botswana can make significant progress toward achieving its Land Degradation Neutrality (LDN) targets, while boosting national agricultural output—which currently represents only 3 percent of its GDP, with about 85 percent derived from livestock production, mainly beef (USDA, 2015).

Neglected crops, new opportunities

Neglected and Underutilized Species (NUS) of crops such as millet and lablab offer promising solutions to the challenges of increased climate variability, land degradation and food and nutrition insecurity. Millet is a drought-resilient, nutrient-rich crop that traditionally played an important role in local diets but has become marginalized in recent decades (Tadele, 2016). Lablab, a fast-growing legume used for livestock fodder, improves soil health, reduces feed costs, and enhances the productivity of mixed crop-livestock systems (Madzonga and Mogotsi, 2014). Despite their potential, both crops remain underused due to limited seed access, weak market demand, and inadequate technical support for cultivation and processing.

Nature-based responses to human-wildlife conflict

Human-wildlife conflict, particularly crop damage caused by elephants, poses a major challenge to rural livelihoods (Gupta, 2013). Innovative practices such as live fencing integrated with beekeeping are gaining attention (Thomasy, 2019).[1]

[1] Living fences are natural barriers, which can be created from dense vegetation, thorny species, or structures enhanced with elements like beehives to discourage animals from entering farmland.

KEY FACTS

Sustainable Landscapes Production Framework (SLPF)

A framework to harness positive agriculture-forestry-energy linkages by providing capacity development and income generating opportunities.

Geographic scope

Tutume and Chobe districts, Botswana.

Source: United Nations Geospatial. 2011. Map of Botswana. In: United Nations. New York, USA, UN. [Cited 4 July 2024]. https:// www.un.org/geospatial/content/botswana

Note: Refer to the disclaimer on the last page for the names and boundaries used in this map.

Target group

Forest and Farm Producer Organizations (FFPOs) and Community members

Gender

Based on the assessments undertaken in the landscape, 52 percent of households are female led. The approach focuses on gender-inclusive interventions to empower women and ensure equitable participation in value chains.

Type of shock/crisis

Over the past three years, 92.8 percent of FFPO members experienced climatic shocks, with drought (61.2 percent) and extreme heat (46.3 percent) being the most frequently experienced shocks.

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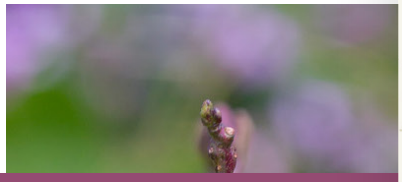
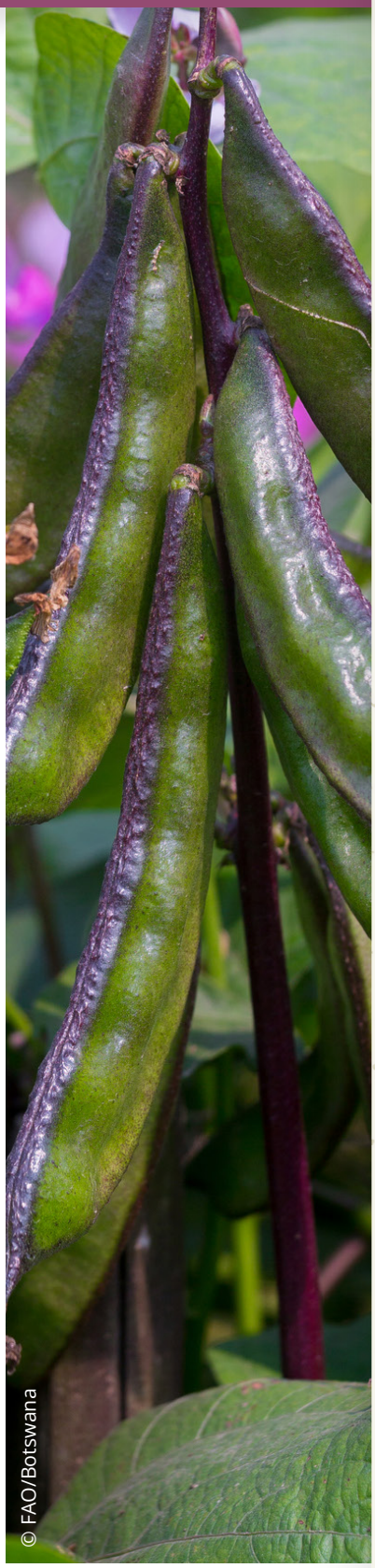


Targeted interventions start with understanding the landscape - ILAM ensures decisions are backed by evidence.



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These low-cost and ecologically sound strategies not only deter wildlife from damaging croplands but also provide income from honey and promote pollination services (King *et al.*, 2017).

The DSL-IP approach in Botswana

Building on existing local knowledge and practices, the FAO-led Dryland Sustainable Landscapes Impact Program (DSL-IP) and its partners in Botswana are working to scale up these promising practices. The project has mapped Forest and Farm Producer Organizations (FFPOs) in its target landscapes with the potential to become hubs of knowledge on integrated and sustainable production. The groups are being included in capacity development activities on sustainable cultivation and market integration of millet and lablab, beekeeping, soil and water conservation, and more. The diverse array of interventions led by the project aim to reduce land degradation and the pressure on the Miombo-Mopane ecosystem, improving its functionality and services, and creating new livelihood opportunities for communities living in it.

These efforts contribute directly to Botswana's ambitious LDN targets, which includes the restoration of 5 percent of its degraded areas, including 10 percent reduction of forests degradation, and rehabilitation of 5 percent of degraded grasslands by 2030.

EVIDENCE-BASED, TARGETED AND TAILORED INTERVENTIONS

To ensure interventions are tailored and impactful, the project is applying the Integrated Landscape Assessment Methodology (ILAM) - a multi-level approach combining geospatial layers, focus groups discussions, field assessments, and household-level data on resilience and behavior, to ensure local context and evidence from the ground is used to refine and improve planned interventions by the project.

Findings from over 538 households reveal both the observed benefits and remaining challenges in cultivating lablab and millet (see figure 1).

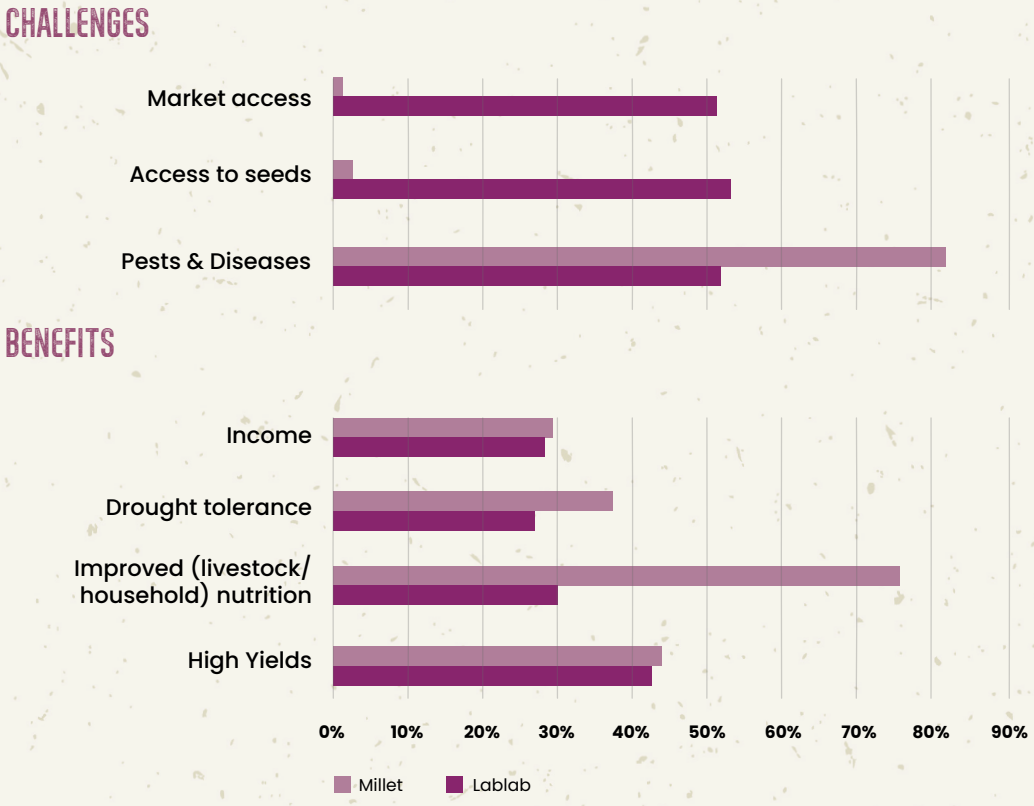

Figure 1: Observed benefits and challenges to cultivating lablab (n=115) and millet (n=320) among farmers in the project landscapes.
Source: Author's elaboration as result of SHARP+ Behavioural Change Household Survey carried out in Tutume Mosetse and Chobe districts of Botswana

Strengthening lablab, millet and live fencing means empowering farmers with knowledge, resources, and market opportunities

STRENGTHENING AND UPSCALING LABLAB, MILLETS AND LIVE FENCING

The information and evidence gathered from project landscapes is used by the country project, in close collaboration with the Global Coordination project, as input in the DSL-IP **Sustainable Landscape Production Framework (SLPF)**, an innovative approach to achieving LDN at landscape level composed of three key priority areas of intervention:

- Crop diversification through **Community Seed Banks**
- Peer-farmer learning through **Farmer Field Schools**
- Green value chain development through **Forest and Farm Facility**

The framework is implemented with direct support from FAO's mobilized knowledge hubs under its Community of Practices, and executed with support from national and regional partners, ensuring technical recommendations, best practices, and lessons from previous projects are delivered to government officers, technical experts, service providers, landscape actors, and farmers in the landscape. They enable the scaling out of sustainable land and forest management practices, including improved production and conservation (through Famer Field Schools and Community Seed Banks), business incubation, value addition, and market access (through the Forest and Farm Facility).

By integrating these mechanisms, the program directly supports the sustainable upscaling of lablab and millet cultivation, promoting improved access to climate-resilient seeds, strengthening knowledge on intercropping and soil restoration, and building market linkages for these underutilized crops. This not only helps diversify production systems but also enhances community resilience to climate shocks while restoring degraded landscapes.

Through the DSL-IP Regional Exchange Mechanism (REM), a coordination structure dedicated to the Miombo-Mopane eco-region, the technologies, practices, and lessons from Botswana's implementation of the SLPF are out-scaled to other countries in the region, enhancing the combined knowledge of the program, and fostering South-South cooperation and coordination.

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EXPECTED IMPACTS OF LABLAB, MILLET AND LIVE FENCING

Lablab, millet and beekeeping were selected as a core theme of the DSL-IP country project based on its potential to address multiple landscape-level priorities through an integrated, evidence-based approach. To assess the relevance and transformative potential of this theme within the broader landscape management strategy, three key impact criteria were applied:

- **Livelihoods and gender:** Can the proposed practices provide inclusive economic opportunities and reduce livelihood vulnerabilities, particularly for rural women and youth?
- **Land Degradation Neutrality (LDN):** Do the proposed practices contribute to restoring land productivity, reduce degradation, and increase ecosystem functionality?
- **Upscaling potential:** Is there scope for expanding or replicating the proposed practices in other landscapes or contexts within Botswana or beyond?

The following section outlines how these value chains and associated practices can contribute to each of these impact areas.

INTERVENTION	FARMING SYSTEM CHALLENGE	POTENTIAL FOR SYSTEM TRANSFORMATION	HOW THE SUSTAINABLE LANDSCAPES PRODUCTION FRAMEWORK SUPPORTS DELIVERY OF BENEFITS
IMPACT AREA: **Livelihoods and Gender Equality**			
Sustainable cultivation of Lablab and Millet	Unpredictable rainfall and recurrent droughts leave households food-and feed-insecure.	Lablab is a drought-hardy legume used for livestock fodder, improving feed availability during the dry season.	**Farmer Field Schools (FFS)** strengthen farmer knowledge on drought-resilient intercropping, fodder preservation, and water-efficient practices; **Community Seed Banks (CSBs)** ensure timely access to adapted seed varieties, reduce post-harvest losses due to improper storage.
	Rural households in Botswana face ongoing food security challenges due to limited agricultural output, arid climates, and recurrent drought .	Millet is nutrient-dense and offers reliable yields under low-rainfall conditions, making it a strong option for household food security and dietary diversity.	**CSBs** secure farmer access to climate-resilient millet seeds; **FFS** share adaptive cultivation techniques for improved yields; **Forest and Farm Facility (FFF)** links producers to niche nutrition markets.
	High cost and limited accessibility of inputs such as seeds.	Adapted varieties of lablab and millet can be maintained, improved and share through community seed banks, ensuring farmer's access to seeds for the growing season.	**CSBs** facilitate seed exchange and participatory variety selection.
	Market isolation and limited value chain participation for smallholder farmers.	Open up income opportunities through value addition, local processing, and access to niche markets.	**FFF** supports value addition, business incubation and market linkages for millet, lablab, and beekeeping products.
	Women are often marginalized in economic activities.	Create platforms for women's leadership and income generation through women-led seed production and processing cooperatives.	**FFF** supports women-led enterprises; **FFS** integrate gender-sensitive training.
	Livestock productivity is limited by seasonal feed shortages and poor feed/fodder quality, reducing household resilience.	Local production and processing of fodder crops like lablab can reduce household vulnerability during periods of feed scarcity, stabilizing livestock-based livelihoods.	**FFS** promote improved fodder storage and utilization; **CSBs** secure seed supply for fodder crops.

INTERVENTION	FARMING SYSTEM CHALLENGE	POTENTIAL FOR SYSTEM TRANSFORMATION	HOW THE SUSTAINABLE LANDSCAPES PRODUCTION FRAMEWORK SUPPORTS DELIVERY OF BENEFITS
IMPACT AREA: **Livelihoods and Gender Equality**			
Beekeeping (Beehive Fences)	Overdependency on single income streams leaves households vulnerable to climate and other type of shocks.	Diversifies household income through honey, pollen and wax production.	**FFF** supports beekeeping product marketing; **FFS** trains on apiary management and processing.
	Women are often marginalized in economic activities.	Women engaged in value-added honey processing.	**FFF** supports women's beekeeping cooperatives; **FFS** provide technical and entrepreneurial skills for honey processing.
IMPACT AREA: **Land Degradation Neutrality**			
Sustainable cultivation of Lablab and Millet	Most households rely on only one or two different sources of income, with limited diversity of agricultural activities and scarce perennial crop cultivation.	Lablab and Millet can be integrated with other cultivated crops or be supported by agroforestry practices.	**FFS** curricula capacitate farmers on the integration of trees into farming systems; **CSBs** provide a platform to save and share adapted seeds suitable for agroforestry systems.
	Overgrazing and land degradation from livestock pressure and reduced grazing quality due to climate shocks.	Cultivation of lablab reduces grazing pressure through increased availability of fodder in dry periods.	**FFS** teach soil restoration practices and how to integrate legumes such as lablab into cropping cycles to fully harness the benefits; **CSBs** secure access to soil-adapted varieties.
	Farmers face declining yields due to degraded, marginal soils, Soil nutrient depletion and erosion.	Millet and lablab's adaptability to poor soils and drought conditions helps stabilize yields on degraded land. Cultivating lablab improves soil health and reduces erosion.	
		Promotes ecological functionality via integrated systems.	
Beekeeping (Beehive Fences)	Farmers expand agricultural land at the expense of natural vegetation and grasslands due to livelihood pressure.	Beekeeping provides a variety of products (honey, pollen, royal jelly, propolis, beeswax) for household use and as income alternatives, decreasing incentives for land conversion or over-exploitation.	**FFF** develops honey value chains; **FFS** train in sustainable hive placement and management.
	Wildlife, particularly elephants, destroy crops and threaten farmer safety, causing income loss, food insecurity, and escalating human-wildlife tensions.	Live fencing with beehives has shown strong potential to reduce human-wildlife conflict without resorting to harmful deterrents and is particularly. well suited to areas bordering protected areas or wildlife corridors.	**FFS** demonstrate beehive fence installation.
	Decline in pollinators threatens long-term productivity of farming systems.	Honeybees are pollinators of various crops and native plants, increasing productivity on-farm and contributing to biodiversity.	**FFS** integrate pollinator conservation into farming practices; **CSBs** can provide pollinator friendly crop seeds.

INTERVENTION	FARMING SYSTEM CHALLENGE	POTENTIAL FOR SYSTEM TRANSFORMATION	HOW THE SUSTAINABLE LANDSCAPES PRODUCTION FRAMEWORK SUPPORTS DELIVERY OF BENEFITS
IMPACT AREA: **Upscaling of Good Practices**			
Sustainable cultivation of Lablab and Millet, and Beekeeping	Drought, soil degradation, and human-wildlife conflict are not isolated to Botswana, they are common across the Miombo-Mopane ecoregion and other dryland landscapes globally. The combined promotion of drought-tolerant crops, soil-restorative legumes, and nature-based conflict mitigation creates a solution package that resonates beyond national borders. It is transferable to neighbouring countries facing similar socio-ecological pressures.		
	Beekeeping with beehive fences is low-cost and scalable, using local materials and traditional knowledge while delivering rapid livelihood returns. This makes the approach easy to adopt for smallholders with limited resources.		
	Millet, lablab, and beekeeping are not exotic interventions, they are rooted in practices familiar to many smallholder farmers but often overlooked in formal extension systems. Supporting and systematizing these practices through cooperatives, community seed banks, and regional exchanges creates scalable models that respect local knowledge while introducing new market and value chain opportunities.		
	The integrated approach aligns with multiple international frameworks: the UNCCD's Land Degradation Neutrality targets, the Sustainable Development Goals (particularly 1, 2, 5, 13, and 15), the United Nations Decade on Ecosystem Restoration, and regional strategies for dryland resilience. Its relevance for food security, biodiversity conservation, climate adaptation, and poverty reduction increases its eligibility for support under donor, government, and private sector		

Table 1: Pathways to Land Degradation Neutrality: How Lablab, Millet, and Beekeeping Restore Dryland Ecosystems
Source: Author's elaboration.

Even with these widely recognized benefits, the full potential lablab, millet and live fencing through sustainable beekeeping remains underutilized due to challenges like limited market access, low awareness of their economic and ecological benefits, and weak extension support (Teshome *et al.,* 2024). However, there is strong potential to scale up these integrated solutions across Botswana's dryland regions and into other parts of the Miombo-Mopane ecoregion. Farmers across southern Africa are already experimenting with drought-tolerant species and community-based strategies to manage natural resources and wildlife pressures.

In conclusion, Botswana's focus on these themes offers a pathway to achieving its LDN targets. These practices, embedded within regenerative farming systems, rebuild soil health, enhance biodiversity, and restore the productivity potential of degraded lands. By diversifying livelihoods, providing alternative income sources, and focusing on on-farm fodder production, they also reduce pressure on grassland and forest resources, helping to curb further degradation. Through regional learning and supportive policy frameworks, the DSL-IP is helping to scale these solutions - supporting food security, ecosystem restoration, and sustainable land use across Southern Africa.

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